

OP1741seqUS
SEQUENCE LISTING

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<120> Method for producing L-arginine or L-lysine by fermentation

<130>

<150> JP 2003-

<151> 2003-03-03

<160> 24

<170> PatentIn Ver. 2.0

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<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:primer for PCR

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<210> 2

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<223> Description of Artificial Sequence:primer for PCR

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<223> Description of Artificial Sequence:primer for PCR

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<223> Description of Artificial Sequence:primer for PCR

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<213> Artificial Sequence

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Met Ser

1

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5 10 15
act gca cgc caa gct ctc att ttg cag att ttg gac aaa caa aaa gtc 1953
Thr Ala Arg Gln Ala Leu Ile Leu Gln Ile Leu Asp Lys Gln Lys Val
20 25 30
acc agc cag gta caa ctg tct gaa ttg ctg ctg gat gaa ggc atc gat 2001
Thr Ser Gln Val Gln Leu Ser Glu Leu Leu Leu Asp Glu Gly Ile Asp
35 40 45 50
atc acc cag gcc acc ttg tcc cgg gat ctc gat gaa ctc ggt gca cgc 2049
Ile Thr Gln Ala Thr Leu Ser Arg Asp Leu Asp Glu Leu Gly Ala Arg
55 60 65
aag gtt cgc ccc gat ggg gga cgc gcc tac tac gcg gtc ggc cca gta 2097
Lys Val Arg Pro Asp Gly Gly Arg Ala Tyr Tyr Ala Val Gly Pro Val
70 75 80
gat agc atc gcc cgc gaa gat ctc cgg ggt ccg tcg gag aag ctg cgc 2145
Asp Ser Ile Ala Arg Glu Asp Leu Arg Gly Pro Ser Glu Lys Leu Arg
85 90 95
cgc atg ctt gat gaa ctg ctg gtt tct aca gat cat tcc ggc aac atc 2193
Arg Met Leu Asp Glu Leu Leu Val Ser Thr Asp His Ser Gly Asn Ile
100 105 110
gcg atg ctg cgc acc ccg ccg gga gct gcc cag tac ctg gca agt ttc 2241
Ala Met Leu Arg Thr Pro Pro Gly Ala Ala Gln Tyr Leu Ala Ser Phe
115 120 125 130
atc gat agg gtg ggg ctg aaa gaa gtc gtt ggc acc atc gct ggc gat 2289
Ile Asp Arg Val Gly Leu Lys Glu Val Val Gly Thr Ile Ala Gly Asp
135 140 145
gac acc gtt ttt gtt ctc gcc cgt gat ccg ctc aca ggt aaa gaa cta 2337
Asp Thr Val Phe Val Leu Ala Arg Asp Pro Leu Thr Gly Lys Glu Leu
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Gly Glu Leu Leu Ser Gly Arg Thr Thr
165 170

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<211> 171

<212> PRT

<213> Brevibacterium flavum

<400> 16

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          20          25          30
Lys Val Thr Ser Gln Val Gln Leu Ser Glu Leu Leu Asp Glu Gly
          35          40          45
Ile Asp Ile Thr Gln Ala Thr Leu Ser Arg Asp Leu Asp Glu Leu Gly
          50          55          60
Ala Arg Lys Val Arg Pro Asp Gly Gly Arg Ala Tyr Tyr Ala Val Gly
          65          70          75          80
Pro Val Asp Ser Ile Ala Arg Glu Asp Leu Arg Gly Pro Ser Glu Lys
          85          90          95
Leu Arg Arg Met Leu Asp Glu Leu Leu Val Ser Thr Asp His Ser Gly
          100          105          110
Asn Ile Ala Met Leu Arg Thr Pro Pro Gly Ala Ala Gln Tyr Leu Ala
          115          120          125
Ser Phe Ile Asp Arg Val Gly Leu Lys Glu Val Val Gly Thr Ile Ala
          130          135          140
Gly Asp Asp Thr Val Phe Val Leu Ala Arg Asp Pro Leu Thr Gly Lys
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Glu Leu Gly Glu Leu Leu Ser Gly Arg Thr Thr
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<210> 17

<211> 3138

<212> DNA

<213> Brevibacterium lactofermentum

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<221> CDS

<222> (1)..(3138)

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Asp Pro Leu Pro Lys Val Gly Ser Leu Ser Leu Lys Ser Glu His Ala	
20 25 30	
caa gca gat cta gag cat ttg ggt tgg cgc aat gtt gag tct ttg gat	144
Gln Ala Asp Leu Glu His Leu Gly Trp Arg Asn Val Glu Ser Leu Asp	
35 40 45	
ttg ttg tgg ggc ttg tca ggt gca ggc gat ccc gat gtc gcg ctg aac	192
Leu Leu Trp Gly Leu Ser Gly Ala Gly Asp Pro Asp Val Ala Leu Asn	
50 55 60	
ctt ctt att cgg ctg tat cag gca ctt gaa gca atc ggc gag gat gct	240
Leu Leu Ile Arg Leu Tyr Gln Ala Leu Glu Ala Ile Gly Glu Asp Ala	
65 70 75 80	
cga aac gag ctt gat caa gag att cgc cag gat gaa gaa cta cga gtc	288
Arg Asn Glu Leu Asp Gln Glu Ile Arg Gln Asp Glu Glu Leu Arg Val	
85 90 95	
cgc ctt ttt gca ttg ttg ggt ggt tcc tcg gct gtc ggt gat cac ttg	336
Arg Leu Phe Ala Leu Leu Gly Gly Ser Ser Ala Val Gly Asp His Leu	
100 105 110	
gtc gcc aat cct ttg cag tgg aaa ctc tta aaa ctt gat gcg cca tcg	384
Val Ala Asn Pro Leu Gln Trp Lys Leu Leu Lys Leu Asp Ala Pro Ser	
115 120 125	
agg gaa gag atg ttt cag gcg ctg ctg gaa tct gtg aaa gct cag cct	432
Arg Glu Glu Met Phe Gln Ala Leu Leu Glu Ser Val Lys Ala Gln Pro	
130 135 140	
gct gtg ctt gag gtt gag gat ttc agc gat gca cac aac att gcc cga	480
Ala Val Leu Glu Val Glu Asp Phe Ser Asp Ala His Asn Ile Ala Arg	
145 150 155 160	
gac gat ttg agc acg cct ggt ttt tac acg gct agt gtt acc ggg cct	528
Asp Asp Leu Ser Thr Pro Gly Phe Tyr Thr Ala Ser Val Thr Gly Pro	
165 170 175	
gaa gca gag cga gtc ttg aaa tgg act tat cgc acg ttg ctg acc cgg	576
Glu Ala Glu Arg Val Leu Lys Trp Thr Tyr Arg Thr Leu Thr Arg	
180 185 190	
att gct gcg cat gat tta gcg ggt acc tat ccc acc gac atg cgg aga	624
Ile Ala Ala His Asp Leu Ala Gly Thr Tyr Pro Thr Asp Met Arg Arg	
195 200 205	
aaa ggt ggc gat cct gtt ccg ttt agc aca gtg acc atg cag ctc agc	672
Lys Gly Gly Asp Pro Val Pro Phe Ser Thr Val Thr Met Gln Leu Ser	
210 215 220	
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Asp Leu Ala Asp Ala Ala Leu Thr Ala Ala Leu Ala Val Ala Ile Ala	
225 230 235 240	
aat gtt tat ggt gaa aag ccg gtt gat tca gct tta tct gtc atc gcg	768
Asn Val Tyr Gly Glu Lys Pro Val Asp Ser Ala Leu Ser Val Ile Ala	
245 250 255	
atg ggc aaa tgt ggc gcg cag gaa ttg aac tac att tca gat gtg gac	816
Met Gly Lys Cys Gly Ala Gln Glu Leu Asn Tyr Ile Ser Asp Val Asp	
260 265 270	
gtg gtg ttt gtt gca gag ccg gca aac tct aaa tca aca cgc acc gca	864
Val Val Phe Val Ala Glu Pro Ala Asn Ser Lys Ser Thr Arg Thr Ala	
275 280 285	
gca gag ctc att cgc atc ggt agc aac tcg ttc ttt gag gtg gat gca	912
Ala Glu Leu Ile Arg Ile Gly Ser Asn Ser Phe Phe Glu Val Asp Ala	
290 295 300 305	
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310 315 320	
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Ser His Met Ala Tyr Tyr Lys Arg Trp Ala Glu Thr Trp Glu Phe Gln	

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Ser	Tyr	Val	Asp	Ala	Leu	Ser	Pro	Leu	Ile	Trp	Ala	Ser	Gln	Arg	
				355					360					365	
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Glu	Ser	Phe	Val	Thr	Asp	Val	Gln	Ala	Met	Arg	Arg	Arg	Val	Leu	Asp
				370					375					380	
aat	ggt	ccg	gaa	gac	ttg	cgt	gat	cgt	gag	ctg	aag	ctt	ggt	cgc	ggt
Asn	Val	Pro	Glu	Asp	Leu	Arg	Asp	Arg	Glu	Leu	Lys	Leu	Gly	Arg	Gly
				385					390					400	
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Gly	Leu	Arg	Asp	Val	Glu	Phe	Ala	Val	Gln	Leu	Leu	Gln	Met	Val	His
				405					410					415	
ggt	cgc	att	gat	gag	acg	ttg	cgg	gtt	cgg	tca	acg	gta	aat	gct	ttg
Gly	Arg	Ile	Asp	Glu	Thr	Leu	Arg	Val	Arg	Ser	Thr	Val	Asn	Ala	Leu
				420					425					430	
cat	gtg	ttg	gtt	gat	cag	gga	tat	gtg	ggt	cg	gaa	gac	ggg	cat	aat
His	Val	Leu	Val	Asp	Gln	Gly	Tyr	Val	Gly	Arg	Glu	Asp	Gly	His	Asn
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Leu	Ile	Glu	Ser	Tyr	Glu	Phe	Leu	Arg	Leu	Leu	Glu	His	Arg	Leu	Gln
				450					455					460	
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gag	caa	agt	tcg	gcc	aaa	gct	atg	gaa	cg	cat	ttg	cg	aag	gtt	cgt
Glu	Gln	Ser	Ser	Ala	Lys	Ala	Met	Glu	Arg	His	Leu	Arg	Lys	Val	Arg
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Leu	Gln	Ile	Gln	Ser	Leu	His	Ser	Gln	Leu	Phe	Tyr	Arg	Pro	Leu	Leu
				515					520					525	
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Asn	Ser	Val	Val	Asn	Leu	Ser	Ala	Asp	Ala	Ile	Arg	Leu	Ser	Pro	Asp
				530					535					540	
gct	gca	aag	cta	caa	ttg	ggg	gca	ttg	gga	tac	ctg	cat	cca	tca	cgt
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Ala	Tyr	Glu	His	Leu	Thr	Ala	Leu	Ala	Ser	Gly	Ala	Ser	Arg	Lys	Ala
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Lys	Ile	Gln	Ala	Met	Leu	Leu	Pro	Thr	Leu	Met	Glu	Trp	Leu	Ser	Gln
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				595					600					605	
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Ala	Ser	Tyr	Asp	Arg	Ser	Trp	Phe	Leu	Arg	Met	Leu	Arg	Asp	Glu	Gly
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Val	Val	Gly	Gln	Arg	Leu	Met	Arg	Ile	Leu	Gly	Asn	Ser	Pro	Tyr	Ile
				625					630					640	
tct	gaa	ctg	att	atc	tcc	act	ccg	gac	ttt	gtg	aaa	cag	ctg	ggt	gat
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Ile	Gln	Ala	Ala	Arg	Ser	Leu	Arg	Arg	Gln	Glu	Leu	Ala	Arg	Ile	Ala			
		690						695					700					
tct	gct	gat	ttg	ctc	aac	atg	ctc	act	gtt	cag	gaa	gta	tgc	caa	agc			2160
Ser	Ala	Asp	Leu	Leu	Asn	Met	Leu	Thr	Val	Gln	Glu	Val	Cys	Gln	Ser			
		705				710				715					720			
ttg	tca	cta	gtc	tgg	gat	gca	gtg	ttg	gat	gct	gcc	ttg	gat	gca	gaa			2208
Leu	Ser	Leu	Val	Trp	Asp	Ala	Val	Leu	Asp	Ala	Ala	Leu	Asp	Ala	Glu			
				725					730					735				
atc	cgt	gct	gca	ctt	aac	gat	cca	cag	aaa	cca	gat	cag	cct	ctg	gcc			2256
Ile	Arg	Ala	Ala	Leu	Asn	Asp	Pro	Gln	Lys	Pro	Asp	Gln	Pro	Leu	Ala			
			740					745					750					
aat	att	tct	gtg	atc	ggc	atg	ggc	cgt	ttg	ggg	gga	gca	gaa	ctt	gga			2304
Asn	Ile	Ser	Val	Ile	Gly	Met	Gly	Arg	Leu	Gly	Gly	Ala	Glu	Leu	Gly			
			755				760					765						
tac	ggg	tct	gat	gcc	gat	gtg	atg	ttt	gta	tgc	gag	ccg	gta	gcc	ggg			2352
Tyr	Gly	Ser	Asp	Ala	Asp	Val	Met	Phe	Val	Cys	Glu	Pro	Val	Ala	Gly			
		770				775					780							
gtg	gaa	gag	cat	gag	gcc	gtc	aca	tgg	tct	att	gca	atc	tgt	gat	tcc			2400
Val	Glu	Glu	His	Glu	Ala	Val	Thr	Trp	Ser	Ile	Ala	Ile	Cys	Asp	Ser			
					790					795					800			
atg	cgg	tcg	agg	ctt	gca	cag	cct	tcc	ggg	gat	cca	cct	ttg	gag	gtg			2448
Met	Arg	Ser	Arg	Leu	Ala	Gln	Pro	Ser	Gly	Asp	Pro	Pro	Leu	Glu	Val			
				805					810					815				
gat	ctg	ggg	ctg	cgt	cct	gaa	ggg	aga	tct	ggg	gca	att	gtg	cgc	acc			2496
Asp	Leu	Gly	Leu	Arg	Pro	Glu	Gly	Arg	Ser	Gly	Ala	Ile	Val	Arg	Thr			
				820				825					830					
gtt	gat	tcc	tat	gtg	aag	tac	tac	gaa	aag	tgg	ggg	gaa	act	tgg	gag			2544
Val	Asp	Ser	Tyr	Val	Lys	Tyr	Tyr	Glu	Lys	Trp	Gly	Glu	Thr	Trp	Glu			
			835				840					845						
att	cag	gca	ctg	ctg	agg	gct	gca	tgg	gtt	gct	ggg	gat	cgt	gag	ctg			2592
Ile	Gln	Ala	Leu	Leu	Arg	Ala	Ala	Trp	Val	Ala	Gly	Asp	Arg	Glu	Leu			
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ggc	att	aag	ttc	ttg	gag	tcg	att	gat	cgt	ttc	cgc	tac	cca	gtt	gac			2640
Gly	Ile	Lys	Phe	Leu	Glu	Ser	Ile	Asp	Arg	Phe	Arg	Tyr	Pro	Val	Asp			
					870				875					880				
ggg	gca	acg	cag	gca	cag	ctt	cgt	gaa	gtt	cgt	cga	att	aag	gca	agg			2688
Gly	Ala	Thr	Gln	Ala	Gln	Leu	Arg	Glu	Val	Arg	Arg	Ile	Lys	Ala	Arg			
				885				890						895				
gtg	gat	aat	gag	agg	ctt	ccg	cgc	ggg	gct	gat	cga	aat	acc	cat	acc			2736
Val	Asp	Asn	Glu	Arg	Leu	Pro	Arg	Gly	Ala	Asp	Arg	Asn	Thr	His	Thr			
			900					905					910					
aag	ctg	ggg	cgg	gga	gca	tta	act	gac	atc	gag	tgg	act	gtg	cag	ttg			2784
Lys	Leu	Gly	Arg	Gly	Ala	Leu	Thr	Asp	Ile	Glu	Trp	Thr	Val	Gln	Leu			
			915				920					925						
ttg	acc	atg	atg	cat	gct	cat	gag	att	ccg	gag	ctg	cac	aat	acg	tcg			2832
Leu	Thr	Met	Met	His	Ala	His	Glu	Ile	Pro	Glu	Leu	His	Asn	Thr	Ser			
			930			935					940							
acg	ttg	gaa	gtt	ctt	gaa	gtg	ctg	gaa	aag	cat	cag	att	att	aac	cct			2880
Thr	Leu	Glu	Val	Leu	Glu	Val	Leu	Glu	Lys	His	Gln	Ile	Ile	Asn	Pro			
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gtg	cag	gtg	cag	acg	ctt	cgg	gaa	gca	tgg	ctg	acg	gca	acg	gct	gct			2928
Val	Gln	Val	Gln	Thr	Leu	Arg	Glu	Ala	Trp	Leu	Thr	Ala	Thr	Ala	Ala			
				965					970					975				
agg	aat	gca	ctt	gtg	ctg	gtc	agg	ggg	aga	tta	gat	cag	tta	cct				2976
Arg	Asn	Ala	Leu	Val	Leu	Val	Arg	Gly	Lys	Arg	Leu	Asp	Gln	Leu	Pro			
			980					985					990					
act	cct	ggg	ccg	cac	ctt	gca	cag	gtg	gct	ggg	gca	tct	ggg	tgg	gat			3024
Thr	Pro	Gly	Pro	His	Leu	Ala	Gln	Val	Ala	Gly	Ala	Ser	Gly	Trp	Asp			

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	995		1000		1005														
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Pro	Asn	Glu	Tyr	Gln	Glu	Tyr	Leu	Glu	Asn	Tyr	Leu	Lys	Val	Thr	Arg				3072
	1010					1015					1020								
aag	agt	cgt	cag	gtt	gtt	gat	gaa	gtc	ttc	tgg	ggt	gtg	gac	tct	atg				3120
Lys	Ser	Arg	Gln	Val	Val	Asp	Glu	Val	Phe	Trp	Gly	Val	Asp	Ser	Met				
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gag	caa	cgt	gag	ttt	tag														3138
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 <213> Brevibacterium lactofermentum

<400> 18

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Gln	Ala	Asp	Leu	Glu	His	Leu	Gly	Trp	Arg	Asn	Val	Glu	Ser	Leu	Asp				
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Leu	Leu	Trp	Gly	Leu	Ser	Gly	Ala	Gly	Asp	Pro	Asp	Val	Ala	Leu	Asn				
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Leu	Leu	Ile	Arg	Leu	Tyr	Gln	Ala	Leu	Glu	Ala	Ile	Gly	Glu	Asp	Ala				
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Arg	Asn	Glu	Leu	Asp	Gln	Glu	Ile	Arg	Gln	Asp	Glu	Glu	Leu	Arg	Val				
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Arg	Leu	Phe	Ala	Leu	Leu	Gly	Gly	Ser	Ser	Ala	Val	Gly	Asp	His	Leu				
			100					105					110						
Val	Ala	Asn	Pro	Leu	Gln	Trp	Lys	Leu	Leu	Lys	Leu	Asp	Ala	Pro	Ser				
		115					120					125							
Arg	Glu	Glu	Met	Phe	Gln	Ala	Leu	Leu	Glu	Ser	Val	Lys	Ala	Gln	Pro				
	130					135					140								
Ala	Val	Leu	Glu	Val	Glu	Asp	Phe	Ser	Asp	Ala	His	Asn	Ile	Ala	Arg				
	145				150				155					160					
Asp	Asp	Leu	Ser	Thr	Pro	Gly	Phe	Tyr	Thr	Ala	Ser	Val	Thr	Gly	Pro				
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Glu	Ala	Glu	Arg	Val	Leu	Lys	Trp	Thr	Tyr	Arg	Thr	Leu	Leu	Thr	Arg				
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Ile	Ala	Ala	His	Asp	Leu	Ala	Gly	Thr	Tyr	Pro	Thr	Asp	Met	Arg	Arg				
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Lys	Gly	Gly	Asp	Pro	Val	Pro	Phe	Ser	Thr	Val	Thr	Met	Gln	Leu	Ser				
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Asp	Leu	Ala	Asp	Ala	Ala	Leu	Thr	Ala	Ala	Leu	Ala	Val	Ala	Ile	Ala				
	225				230				235					240					
Asn	Val	Tyr	Gly	Glu	Lys	Pro	Val	Asp	Ser	Ala	Leu	Ser	Val	Ile	Ala				
				245				250						255					
Met	Gly	Lys	Cys	Gly	Ala	Gln	Glu	Leu	Asn	Tyr	Ile	Ser	Asp	Val	Asp				
			260					265					270						
Val	Val	Phe	Val	Ala	Glu	Pro	Ala	Asn	Ser	Lys	Ser	Thr	Arg	Thr	Ala				
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Ala	Leu	Arg	Pro	Glu	Gly	Lys	Ser	Gly	Ala	Leu	Val	Arg	Ser	Leu	Asp				
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Ser	His	Met	Ala	Tyr	Tyr	Lys	Arg	Trp	Ala	Glu	Thr	Trp	Glu	Phe	Gln				
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Ala	Leu	Leu	Lys	Ala	Arg	Pro	Met	Thr	Gly	Asp	Ile	Asp	Leu	Gly	Gln				
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Ser	Tyr	Val	Asp	Ala	Leu	Ser	Pro	Leu	Ile	Trp	Ala	Ala	Ser	Gln	Arg				
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Glu	Ser	Phe	Val	Thr	Asp	Val	Gln	Ala	Met	Arg	Arg	Arg	Val	Leu	Asp
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Asn	Val	Pro	Glu	Asp	Leu	Arg	Asp	Arg	Glu	Leu	Lys	Leu	Gly	Arg	Gly
385					390					395					400
Gly	Leu	Arg	Asp	Val	Glu	Phe	Ala	Val	Gln	Leu	Leu	Gln	Met	Val	His
				405					410					415	
Gly	Arg	Ile	Asp	Glu	Thr	Leu	Arg	Val	Arg	Ser	Thr	Val	Asn	Ala	Leu
			420					425					430		
His	Val	Leu	Val	Asp	Gln	Gly	Tyr	Val	Gly	Arg	Glu	Asp	Gly	His	Asn
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Leu	Ile	Glu	Ser	Tyr	Glu	Phe	Leu	Arg	Leu	Leu	Glu	His	Arg	Leu	Gln
	450					455					460				
Leu	Glu	Arg	Ile	Lys	Arg	Thr	His	Leu	Leu	Pro	Lys	Pro	Asp	Asp	Arg
465					470					475					480
Met	Asn	Met	Arg	Trp	Leu	Ala	Arg	Ala	Ser	Gly	Phe	Thr	Gly	Ser	Met
				485					490					495	
Glu	Gln	Ser	Ser	Ala	Lys	Ala	Met	Glu	Arg	His	Leu	Arg	Lys	Val	Arg
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Leu	Gln	Ile	Gln	Ser	Leu	His	Ser	Gln	Leu	Phe	Tyr	Arg	Pro	Leu	Leu
		515					520					525			
Asn	Ser	Val	Val	Asn	Leu	Ser	Ala	Asp	Ala	Ile	Arg	Leu	Ser	Pro	Asp
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Ala	Ala	Lys	Leu	Gln	Leu	Gly	Ala	Leu	Gly	Tyr	Leu	His	Pro	Ser	Arg
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Ala	Tyr	Glu	His	Leu	Thr	Ala	Leu	Ala	Ser	Gly	Ala	Ser	Arg	Lys	Ala
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Lys	Ile	Gln	Ala	Met	Leu	Leu	Pro	Thr	Leu	Met	Glu	Trp	Leu	Ser	Gln
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Thr	Ala	Glu	Pro	Asp	Ala	Gly	Leu	Asn	Tyr	Arg	Lys	Leu	Ser	Asp	
		595					600				605				
Ala	Ser	Tyr	Asp	Arg	Ser	Trp	Phe	Leu	Arg	Met	Leu	Arg	Asp	Glu	Gly
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Val	Val	Gly	Gln	Arg	Leu	Met	Arg	Ile	Leu	Gly	Asn	Ser	Pro	Tyr	Ile
625					630					635					640
Ser	Glu	Leu	Ile	Ile	Ser	Thr	Pro	Asp	Phe	Val	Lys	Gln	Leu	Gly	Asp
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Ala	Ala	Ser	Gly	Pro	Lys	Leu	Leu	Ala	Thr	Ala	Pro	Thr	Gln	Val	Val
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Lys	Ala	Ile	Lys	Ala	Thr	Val	Ser	Arg	His	Glu	Ser	Pro	Asp	Arg	Ala
		675					680					685			
Ile	Gln	Ala	Ala	Arg	Ser	Leu	Arg	Arg	Gln	Glu	Leu	Ala	Arg	Ile	Ala
	690					695					700				
Ser	Ala	Asp	Leu	Leu	Asn	Met	Leu	Thr	Val	Gln	Glu	Val	Cys	Gln	Ser
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Leu	Ser	Leu	Val	Trp	Asp	Ala	Val	Leu	Asp	Ala	Ala	Leu	Asp	Ala	Glu
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Ile	Arg	Ala	Ala	Leu	Asn	Asp	Pro	Gln	Lys	Pro	Asp	Gln	Pro	Leu	Ala
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Tyr	Gly	Ser	Asp	Ala	Asp	Val	Met	Phe	Val	Cys	Glu	Pro	Val	Ala	Gly
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Val	Glu	Glu	His	Glu	Ala	Val	Thr	Trp	Ser	Ile	Ala	Ile	Cys	Asp	Ser
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Met	Arg	Ser	Arg	Leu	Ala	Gln	Pro	Ser	Gly	Asp	Pro	Pro	Leu	Glu	Val
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Asp	Leu	Gly	Leu	Arg	Pro	Glu	Gly	Arg	Ser	Gly	Ala	Ile	Val	Arg	Thr
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Val	Asp	Ser	Tyr	Val	Lys	Tyr	Tyr	Glu	Lys	Trp	Gly	Glu	Thr	Trp	Glu
		835					840					845			
Ile	Gln	Ala	Leu	Leu	Arg	Ala	Ala	Trp	Val	Ala	Gly	Asp	Arg	Glu	Leu
	850					855					860				
Gly	Ile	Lys	Phe	Leu	Glu	Ser	Ile	Asp	Arg	Phe	Arg	Tyr	Pro	Val	Asp

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865	Gly	Ala	Thr	Gln	Ala	Gln	Leu	Arg	Glu	Val	Arg	Arg	Ile	Lys	Ala	Arg	880
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	Lys	Leu	Gly	Arg	Gly	Ala	Leu	Thr	Asp	Ile	Glu	Trp	Thr	Val	Gln	Leu	
	Leu	Thr	Met	Met	His	Ala	His	Glu	Ile	Pro	Glu	Leu	His	Asn	Thr	Ser	
	Thr	Leu	Glu	Val	Leu	Glu	Val	Leu	Glu	Lys	His	Gln	Ile	Ile	Asn	Pro	
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	Pro	Asn	Glu	Tyr	Gln	Glu	Tyr	Leu	Glu	Asn	Tyr	Leu	Lys	Val	Thr	Arg	
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<400> 19

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cag	cac	ttc	agc	atc	cca	gct	gcc	agc	ttc	gat	gca	gat	aca	gtc	gaa	144
Gln	His	Phe	Ser	Ile	Pro	Ala	Ala	Ser	Phe	Asp	Ala	Asp	Thr	Val	Glu	
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Asp	Glu	Ser	Asp	Met	Asn	Leu	Leu	Pro	Asp	Leu	Gly	Thr	Ala	Thr	Leu	
			65		70				75						80	
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Asp	Pro	Phe	Arg	Lys	Ala	Lys	Thr	Leu	Asn	Val	Lys	Phe	Phe	Val	His	
				85					90					95		
gat	cct	ttc	acc	cgc	gag	gca	ttc	tcc	cgc	gac	cca	cgc	aac	gta	gca	336
Asp	Pro	Phe	Thr	Arg	Glu	Ala	Phe	Ser	Arg	Asp	Pro	Arg	Asn	Val	Ala	
			100				105						110			
cgc	aag	gca	gag	cag	tac	ctg	gca	tcc	acc	ggc	att	gca	gac	acc	tgc	384
Arg	Lys	Ala	Glu	Gln	Tyr	Leu	Ala	Ser	Thr	Gly	Ile	Ala	Asp	Thr	Cys	
			115				120					125				
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Asn	Phe	Gly	Ala	Glu	Ala	Glu	Phe	Tyr	Leu	Phe	Asp	Ser	Val	Arg	Tyr	
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tcc	acc	gag	atg	aac	tcc	ggc	ttc	tac	gaa	gta	gat	acc	gaa	gaa	ggc	480
Ser	Thr	Glu	Met	Asn	Ser	Gly	Phe	Tyr	Glu	Val	Asp	Thr	Glu	Glu	Gly	

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Trp Trp Asn Arg Gly Lys Glu Thr Asn Leu Asp Gly Thr Pro Asn Leu				
165	170	175		
ggc gca aag aac cgc gtc aag ggt ggc tac ttc cca gta gca cca tac				576
Gly Ala Lys Asn Arg Val Lys Gly Tyr Phe Pro Val Ala Pro Tyr				
180	185	190		
gac caa acc gtt gac gtg cgc gat gac atg gtt cgc aac ctc gca gct				624
Asp Gln Thr Val Asp Val Arg Asp Asp Met Val Arg Asn Leu Ala Ala				
195	200	205		
tcc ggc ttc gct ctt gag cgt ttc cac cac gaa gtc ggt ggc gga cag				672
Ser Gly Phe Ala Leu Glu Arg Phe His His Glu Val Gly Gly Gly Gln				
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Gln Glu Ile Asn Tyr Arg Phe Asn Thr Met Leu His Ala Ala Asp Asp				
225	230	235		
atc cag acc ttc aag tac atc atc aag aac acc gct cgc ctc cac ggc				768
Ile Gln Thr Phe Lys Tyr Ile Ile Lys Asn Thr Ala Arg Leu His Gly				
245	250	255		
aag gct gca acc ttc atg cct aag cca ctg gct ggc gac aac ggt tcc				816
Lys Ala Ala Thr Phe Met Pro Lys Pro Leu Ala Gly Asp Asn Gly Ser				
260	265	270		
ggc atg cac gct cac cag tcc ctc tgg aag gac ggc aag cca ctc ttc				864
Gly Met His Ala His Gln Ser Leu Trp Lys Asp Gly Lys Pro Leu Phe				
275	280	285		
cac gat gag tcc ggc tac gca ggc ctg tcc gac atc gcc cgc tac tac				912
His Asp Glu Ser Gly Tyr Ala Gly Leu Ser Asp Ile Ala Arg Tyr Tyr				
290	295	300		
atc ggc ggc atc ctg cac cac gca ggc gct gtt ctg gcg ttc acc aac				960
Ile Gly Gly Ile Leu His Ala Gly Ala Val Leu Ala Phe Thr Asn				
305	310	315		
gca acc ctg aac tcc tac cac cgt ctg gtt cca ggc ttc gag gct cca				1008
Ala Thr Leu Asn Ser Tyr His Arg Leu Val Pro Gly Phe Glu Ala Pro				
325	330	335		
atc aac ctg gtg tac tca cag cgc aac cgt tcc gct gct gtc cgt atc				1056
Ile Asn Leu Val Tyr Ser Gln Arg Asn Arg Ser Ala Ala Val Arg Ile				
340	345	350		
cca atc acc gga tcc aac cca aag gca aag cgc atc gaa ttc cgc gct				1104
Pro Ile Thr Gly Ser Asn Pro Lys Ala Lys Arg Ile Glu Phe Arg Ala				
355	360	365		
cca gac cca tca ggc aac cca tac ctg ggc ttc gca gcg atg atg atg				1152
Pro Asp Pro Ser Gly Asn Pro Tyr Leu Gly Phe Ala Ala Met Met Met				
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gcc ggc ctc gac ggc atc aag aac cgc atc gag cca cac gct cca gtg				1200
Ala Gly Leu Asp Gly Ile Lys Asn Arg Ile Glu Pro His Ala Pro Val				
385	390	395		
gac aag gac ctc tac gaa ctg cca cca gag gaa gct gca tcc att cca				1248
Asp Lys Asp Leu Tyr Glu Leu Pro Pro Glu Glu Ala Ala Ser Ile cca				
405	410	415		
cag gca cca acc tcc ctg gaa gca tcc ctg aag gca ctg cag gaa gac				1296
Gln Ala Pro Thr Ser Leu Glu Ala Ser Leu Lys Ala Leu Gln Glu Asp				
420	425	430		
acc gac ttc ctc acc gag tct gac gtc ttc acc gag gat ctc atc gag				1344
Thr Asp Phe Leu Thr Glu Ser Asp Val Phe Thr Glu Asp Leu Ile Glu				
435	440	445		
gcg tac atc cag tac aag tac gac aac gag atc tcc cca gtt cgc ctg				1392
Ala Tyr Ile Gln Tyr Lys Tyr Asp Asn Glu Ile Ser Pro Val Arg Leu				
450	455	460		
cgc cca acc ccg cag gaa ttc gaa ttg tac ttc gac tgc taa				1434
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465	470	475		

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<213> Brevibacterium lactofermentum

<400> 20

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Gln	His	Phe	Ser	Ile	Pro	Ala	Ala	Ser	Phe	Asp	Ala	Asp	Thr	Val	Glu
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Thr His Gln Gly Phe Ala Thr Thr Ser Thr His Gln Ile Ala Asp Ala
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Val Gly Ile Arg Gln Ala Ser Leu Tyr Tyr His Phe Pro Ser Lys Thr
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Leu Ala Glu Asp Leu Ser Ile Leu Asp Ala Gly Pro Glu Met Arg Leu
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<213> Brevibacterium lactofermentum

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Arg	Arg	Thr	Gly	Phe	Ala	Phe	Arg	Asn	Ala	Ser	Arg	Arg	Pro	Leu	Asp
			260					265					270		
Leu	Asp	Val	Val	Asp	Ala	Asn	Gly	Thr	Ile	Glu	Leu	Ser	Lys	Lys	Pro
		275					280					285			
Asp	Leu	Asn	Asp	Pro	Ala	Leu	Pro	Leu	Arg	Val	Ala	Ala	Ala	Ala	Ala
	290					295					300				
Thr	Thr	Gly	Leu	Pro	Val	Ala	Glu	Ser	Thr	Trp	Ala	Arg	Leu	Asn	Glu
	305				310					315					320
Cys	Pro	Pro	Leu	Pro	Glu	Pro	Trp	Pro	Ala	Asn	Ala	Ala	Gly	Asp	Phe
				325					330					335	
Phe	Arg	Ile	Leu	Ser	Ser	Pro	Lys	Asn	Ser	Arg	Arg	Val	Val	Lys	Asn
			340					345					350		
Met	Asp	Arg	His	Gly	Leu	Trp	Ser	Arg	Phe	Val	Pro	Glu	Trp	Asp	Arg
		355					360					365			
Ile	Lys	Gly	Leu	Met	Pro	Arg	Glu	Pro	Ser	His	Ile	Ser	Thr	Ile	Asp
	370					375					380				
Glu	His	Ser	Leu	Asn	Thr	Val	Ala	Gly	Cys	Ala	Leu	Glu	Thr	Val	Thr
	385				390					395					400
Val	Ala	Arg	Pro	Asp	Leu	Leu	Val	Leu	Gly	Ala	Leu	Tyr	His	Asp	Ile
				405					410					415	
Gly	Lys	Gly	Phe	Pro	Arg	Pro	His	Glu	Gln	Val	Gly	Ala	Glu	Met	Val
			420					425					430		
Ala	Arg	Ala	Ala	Ser	Arg	Met	Gly	Leu	Asn	Leu	Arg	Asp	Arg	Ala	Ser
		435					440					445			
Val	Gln	Thr	Leu	Val	Ala	Glu	His	Thr	Ala	Val	Ala	Lys	Ile	Ala	Ala
	450					455					460				
Arg	Leu	Asp	Pro	Ser	Ser	Glu	Gly	Ala	Val	Asp	Lys	Leu	Leu	Asp	Ala
	465				470					475					480
Val	Arg	Tyr	Asp	Leu	Val	Thr	Leu	Asn	Leu	Leu	Glu	Val	Leu	Thr	Glu
				485					490					495	
Ala	Asp	Ala	Lys	Ala	Thr	Gly	Pro	Gly	Val	Trp	Thr	Ala	Arg	Leu	Glu
			500					505					510		
His	Ala	Leu	Arg	Ile	Val	Cys	Lys	Arg	Ala	Arg	Asp	Arg	Leu	Thr	Asp
	515						520					525			
Ile	Arg	Pro	Val	Ala	Pro	Met	Ile	Ala	Pro	Arg	Ser	Glu	Ile	Gly	Leu
	530					535					540				
Val	Glu	Arg	Asp	Gly	Val	Phe	Thr	Val	Gln	Trp	His	Gly	Glu	Asp	Leu
	545				550					555					560
His	Arg	Ile	Leu	Gly	Val	Ile	Tyr	Ala	Lys	Gly	Trp	Thr	Ile	Thr	Ala
				565					570					575	
Ala	Arg	Met	Leu	Ala	Asn	Gly	Gln	Trp	Ser	Ala	Glu	Phe	Asp	Val	Arg
			580					585					590		
Ala	Asn	Gly	Pro	Gln	Asp	Phe	Asp	Pro	Gln	His	Phe	Leu	Gln	Ala	Tyr

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		595				600					605						
Gln	Ser	Gly	Val	Phe	Ser	Glu	Val	Pro	Ile	Pro	Ala	Pro	Gly	Ile	Thr		
	610					615					620						
Ala	Thr	Phe	Trp	His	Gly	Asn	Thr	Leu	Glu	Val	Arg	Thr	Glu	Leu	Arg		
625					630					635					640		
Thr	Gly	Ala	Ile	Phe	Ala	Leu	Leu	Arg	Thr	Leu	Pro	Asp	Ala	Leu	Trp		
				645					650					655			
Ile	Asn	Ala	Val	Thr	Arg	Gly	Ala	Thr	Leu	Ile	Ile	Gln	Ala	Ala	Leu		
		660						665					670				
Lys	Pro	Gly	Phe	Asp	Arg	Ala	Thr	Val	Glu	Arg	Ser	Val	Val	Arg	Ser		
		675					680					685					
Leu	Ala	Gly	Ser														
	690																